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3 The IPQMS and Case Histories

The East-West Center initiated an intensive international team study in 1975 to develop a new approach to project management education and training. The mandate to the team was to produce a new generation of managers who would have the analytical skills to ensure cost effectiveness and total quality in all projects in both public and private sectors. A primary objective of the strategy was to design a curriculum that would view planning, design, implementation, and evaluation as integral parts of the total process.

3.1 IPQMS PROTOTYPE CURRICULUM

In September 1976, the project team convened at the East-West Center to present and discuss curriculum development progress reports. It was agreed that the concept of a *prototype curriculum* was necessary — a curriculum that could be adapted to both training and educational programs. It was further agreed that the curriculum would include policy issues related to development projects. A timetable of nine months was established to complete the following materials:

- A syllabus and course outline for a 15- or 16-week curriculum that could be adapted to both academic courses and training programs.
- Identification of selected readings on each task of the integrated project cycle.
- A portfolio of five or six case studies of development projects to be researched and written in the context of the integrated project cycle.
- An annotated bibliography.
- A teacher's guide on the use of these case studies.

The project team reached a consensus on the prototype curriculum in June 1977 at its next meeting at the East-West Center.¹ At that time, it was agreed to implement the curriculum for testing and refinement during the 1977–1978 academic year, provided that the East-West Center could package

all the materials into a 16-week (six hours per day, five days per week) curriculum and deliver it to the participating institutions by September 1977. It was also agreed to develop the curriculum and supporting materials within the IPQMS framework. A final request called for additional case studies of projects from four sectors: agriculture, public works, industry, and social services.

The highlights of the many project team activities from 1977 to 1983 are summarized below:

- A major research grant proposal for support to research and write 30 case histories was submitted to the Exxon Education Foundation in 1977.
- A comparative evaluation of initial implementation of the prototype curriculum was held at the East-West Center in 1978.
- Thirty case histories of development projects in nine countries were completed and published between 1979 and 1982. Twenty-two cases were published by Pergamon Press and eight cases by the East-West Center.
- A basic textbook was published by Pergamon Press in 1980 to replace the selected readings in the prototype curriculum.
- A planning conference on management training for public works projects was convened in 1982. Participants included key persons from industry, government, and academe.
- A seminar for trainers of public works project managers from eight countries was held in 1983.

The syllabus for the prototype curriculum designed in the IPQMS conceptual framework reflects the results of the initial testing in 1977–1978 (Tables 3.1, 3.2, and 3.3), as well as further refinement resulting from a Training of Trainers Seminar in 1983.^{2,3} The initial selected readings to be used with the curriculum resulted from an intensive global literature search in 1976–1977. One thousand pages were finally identified, representing 25 book chapters and/or journal articles from 23 publishers throughout the world. The selected readings were related to the various phases and tasks in the IPQMS. Twenty copies of these readings were reproduced and packaged in 1977 for initial testing purposes. Selected references for these readings are shown for each phase of the IPQMS.⁴⁻⁷ In addition, Goodman and Love packaged a case book containing drafts of five cases researched and written in the IPQMS conceptual framework.⁸

TABLE 3.1
Courses in Project Management in Different Countries*

Country	Academic Course	Training Course
New Zealand	X	X
Malaysia		X
U.S.	X	
Philippines	X	X
Indonesia	X	X
Taiwan	X	
Iran		X

*Courses offered at the institutions represented by the workshop participants.

TABLE 3.2
Comparison of Training Courses Offered

	New Zealand	Malaysia	Philippines	Indonesia
Agency	University	Government planning	University	University
Duration	12 weeks	8 weeks	7 weeks (2 weeks in plant)	32 weeks
No. of participants	18	24	39 (15 in plant)	45

TABLE 3.3
Comparison of Academic Courses Offered

	New Zealand	U.S.	Philippines
Name of university	Massey Univ.	Univ. of Arizona	Univ. of the Philippines De La Salle University
Type of university program/college	Public MBA	Public MPA/Ph.D	Public/private MPA/ME/MBA

3.2 USE OF CASES IN EDUCATION

The evaluation of the initial implementation of the curriculum² concluded that the most important component is a series of IPQMS case histories covering projects from agricultural, industrial, public works, and social sec-

tors. It was also concluded that the case histories must come from a representative cross section of socioeconomic settings.

Case study research has been used throughout the world for over 120 years in teaching law and medicine. It has also been successfully used for about 70 years in teaching business administration. The use of engineering cases is reported to have originated at Stanford University in 1964.⁹ More recently, schools of public affairs and administration have become interested in developing cases for use in strengthening both administration and program management capabilities in developing countries.¹⁰

The East-West Center (EWC) project team decided to conduct a global search of the literature in an attempt to locate case studies that had a focus on the different phases/tasks in the integrated project cycle. This decision was based on the use of five cases packaged by Goodman and Love for the testing of the curriculum in 1977–1978.⁸ The team and EWC graduate students at the University of Hawaii reviewed over 1000 abstracts of cases from the Harvard Graduate School of Business Administration, the Philippine Case Clearing House, and the American Society for Engineering Education (ASEE).

The results were negative. Thus, it was decided to initiate the necessary research and writing of cases in the conceptual framework of the integrated project cycle. It was further decided that these cases should be called case histories since they would be based on autopsies or postmortems of programs and projects. Only in this way could the facts as to why projects failed or succeeded be determined. This type of research is extremely time consuming and could only be carried out with a significant grant from the Exxon Education Foundation.

The guidelines for researching and writing the case histories are covered in Chapter 4.

3.2.1 BUSINESS CASE STUDIES

The Harvard University Business School reports the first business case study was written in the early 1920s. Since then, over 7000 case studies have been produced. They normally focus on a principle, an issue, or the value of a particular approach in making a decision.

Business school cases utilize studies of actual business situations and decisions faced by real corporations, large and small. They may involve a toy redesign problem to improve marketing or an assembly-line problem. In today's economy, a large corporation may be faced with a decision to either expand its portfolio or downsize. Harvard Business School does provide a

publication describing how to prepare case studies for both the instructor and the student.¹¹

3.2.2 ENGINEERING CASE STUDIES

The American Society for Engineering Education maintained an Engineering Case Library (ECL) until the late 1980s.¹² The ECL cases normally deal with specific problem situations or issues, such as a sinking floor (settlement problem) or magnetic fusion. The cases began to include the impact of policy matters in the mid-1980s. They are useful in the classroom for courses in design and production processes. The ASEE engineering cases are now housed at Rose-Hulman Institute of Technology, Terre Haute, Indiana. There were approximately 285 cases as of 1995. The ECL is now jointly administered by ASEE and the Rose-Hulman Institute of Technology.

Another example of engineering cases can now be found at the Massachusetts Institute of Technology (MIT). Dr. John Miller of the Department of Civil and Environmental Engineering has initiated a series of case studies of infrastructure projects in the U.S., Canada, and Hong Kong.¹³ As a point of interest, he includes both questions and task exercises at the end of each case. His cases represent a combination of case studies and case problems.*

According to ASEE, the University of Michigan is developing case studies for every course in chemical engineering.¹⁴ This is a joint effort by both faculty and graduate students.

The majority of business and engineering cases are used in the classroom to help students develop some real-world skills. Of course, the ideal situation in academia occurs when instructors have students work on teams in solving case problems. This means the instructors must develop their own cases unless there are data banks of comprehensive cases available.

3.2.3 IPQMS CASE HISTORIES

These cases are based on autopsies or postmortems of projects. Each case examines and analyzes the entire spectrum of a particular project, from inception through completion, showing how the interrelationships (or lack thereof) among policy makers, planners, designers, implementers, and managers contributed to the success (or failure) of the project. Special emphasis is placed on the feasibility studies in the planning phase to cover all aspects:

* Case problems normally involve a team approach to research the problem over a specific time period.

economic, technical, financial, administrative/managerial, environmental, and social/political.

The cases are a record of events and issues that actually have been faced by managers: events interwoven with facts, opinions, prejudices, and data upon which the manager's decisions depended. They contain the experience and influence of government officials, consultants, international assistance officials, designers, contractors (especially in public works projects), and project managers so that others can learn from these successes and mistakes. The projects presented vary in country, sector, form of management, and funding. The lessons learned have been used in rebuilding the island of Kauai after Hurricane Iniki in 1992.

3.3 SIGNIFICANT DIFFERENCES BETWEEN CASE STUDIES AND IPQMS CASE HISTORIES

The foregoing definitions for case studies and IPQMS case histories are better understood in examining abstracts of cases obtained from the American Society for Engineering Education, the Harvard Business School,¹⁰ and the writers' inventory of case histories. Harvard reports that nearly 100 hours may be required to write a business case. Writing an IPQMS case requires a minimum of 1000 hours (the case of the Trans-Alaskan Pipeline System [TAPS], [Chapter 5](#), required 1500 hours). Indeed, one IPQMS case history will yield ten or more case studies (one for each task).

Abstracts of business/engineering case studies and IPQMS case histories are presented in Appendix A. They vividly illustrate the differences.

3.4 THE NEED FOR CASES BASED ON POSTMORTEMS

There is agreement among many educators, project planners, designers, contractors, and managers regarding the need to provide unified control of all projects in all sectors in order to ensure both quality and cost effectiveness.¹⁵ This eminently qualified group endorsed the principles of the IPQMS conceptual framework for education and training of project planners and managers — the professionals responsible for different aspects of projects from inception through completion. They further agreed on the need for data banks of case histories of public works projects to provide the necessary scientific and engineering data to strengthen project planning and management capabilities. This situation is true of all sectors, but it is especially

crucial in hazardous waste disposal systems because of its direct impact on public health.¹⁶

As noted earlier, this book places heavy emphasis on project feasibility, project evaluation, and the use of IPQMS cases. Regarding the last factor, there is urgent need for case histories of public works projects, especially in areas of hazardous waste disposal and water supply systems. This need is reinforced in the postmortem of EPA Superfund Programs 1 to 3 (Chapter 8).

Thus, it is clear that learning lessons from the past can be invaluable in planning new programs to ensure accountability, cost effectiveness, and quality. The applications of in-depth analyses of past operations, programs, and organizations are beneficial in all sectors and fields. Generals George Patton and Douglas MacArthur were highly successful in World War II because they analyzed the winning strategies employed by General Hannibal of ancient Carthage and other generals in the past. The medical profession has made outstanding progress in finding cures for many diseases because it initiated case research based on autopsies over 120 years ago, maintaining an updated data bank available to physicians worldwide.¹⁷

A worthwhile book on the history of project failure is found in Petroski's *Design Paradigms*.¹⁸ The book provides insight into the design process and the role of failure in design. It contains a history of many examples of design failures, including the reasons for the failures.

The IPQMS framework allows the examination of a broad range of factors that contribute to a project's success or failure. Each case examines and analyzes the entire spectrum of a particular project, from inception through completion, showing how the interrelationships (or lack thereof) among policy makers, planners, designers, implementers, and managers contributed to the success (or failure) of the project. The variety and range of projects documented by the cases further ensure that where one case focuses on technical factors or managerial policy, for example, other cases will complement it with an emphasis in other areas.

The foregoing illustrates the need and potential for educating and training a more effective project manager. This effort requires a curriculum and supporting materials that focus on unified control of all projects. The IPQMS and related cases represent such an approach.

Thirty IPQMS cases have been researched and published as of this writing. Each case is analogous to an autopsy or postmortem of a project in a similar framework, which is essential to establishing a data base in a given field, such as public works.¹⁷ The guidelines for researching and writing the cases are presented in Chapter 4. The authors have completed research on

eight additional postmortems of infrastructure-related projects, and include six in this book (Chapters 5 to 9). Senior scholars and practitioners from industry and academe recommend the use of this type of case, both as a reference and textbook material in architecture, civil engineering, and construction. Twenty-two cases of the initial 30 have been published by Pergamon Press.¹⁹⁻²²

3.5 THE NEED TO TEACH TEAMWORK

Experience with troubleshooting a wide variety of problem areas in public works projects by the senior author clearly pointed to the need for teamwork among the principal parties: the owner, design professional, and contractor. This lesson was learned over 30 years ago. Unfortunately, the same problems persist today in both private and public sectors. The best way to solve this need is to begin educating and training new generations of professionals in the benefits of teamwork. Working together toward common goals will result in accountability, cost effectiveness, and quality. A significant fringe benefit is the minimization of litigation, which has been on the increase in public works projects for the past 20 years.

The IPQMS was developed to ensure teamwork from the principal parties. Using IPQMS case histories calls upon students to think actively and constructively about a real situation.* It requires dealing with contemporaries, communicating ideas, and developing individual decision making and judgment. Often this process must take place in a situation surrounded by conflicting ideas. The case method places an important role on the instructor. The instructor will assign a case for discussion, provoke interest and thinking, guide discussions where necessary, and perhaps bring together in summary form the threads of students' arguments. Each case is in fact a new learning situation and new opportunity for students to express their ideas. Throughout the case discussion students must be encouraged to communicate their views, support their views against disagreements from others, or accept the merits of the others' reasoning.

A careful step-by-step analysis of case facts is an essential prelude to discussion of the case, and students should appraise the specific situations and consider the choices of action available on the various issues. Analysis of case facts should be encouraged by continually focusing upon case details,

* The terms "students" and "participants" are normally used to denote education and training, respectively. The process is identical in teaching the use of cases.

the interrelations of case details and their implications for management action. Instructors should be careful to distinguish between objective facts and a student's evaluation of the facts, as sometimes opinions or comments recorded in a case may be taken as facts and not as a statement of opinion. The instructor must encourage contributors to differentiate between fact and opinion.

In some instances, the instructor will have to focus the attention of the class on points that should be discussed. This may occur when the class becomes so concerned with one aspect of the case that they neglect other issues that should be considered. When this happens, issues should be reviewed with caution, and there may be need to provide a set of criteria for the students. Cases are, in effect, the tools that encourage purposeful thought, and both individual and group creativity. They provide the raw materials from which decisions are made, interaction and intercommunications are established, and ideas are presented, challenged and defended.

At all times, the instructor must keep in mind the case histories provide a direct and intimate view of the role and activities of the project manager. They also focus on the many techniques, relationships, and other factors that contribute to the success or failure of particular projects. For education and training purposes, they provide a realistic context for analyzing the management of projects. As a reference, they provide both scholars and practitioners with useful insights in (1) planning and managing new projects, and (2) troubleshooting on-going projects.

3.5.1 USING THE TEAM METHOD

Experience with the IPQMS in both education and practice demonstrates the usefulness of selecting topics from each of the four phases for class or team discussions and homework assignments. The instructor will divide the class into effective team groups of three or four students to understand the benefits of a team approach by all parties working towards a common goal. Effective team division ensures that students from different backgrounds and disciplines will work together and define common grounds to resolve issues.

At the very start, the instructor and the teams should emphasize the following guidelines to achieve results:

- Clarification of the team's purpose and the role of each member
- Smooth communication and interaction among members
- Unrestrained expression of, and access to, ideas of team members

- Acceptance and recognition of contending opinions within the group
- Trusting, but not fraternal, relationships within the group

The instructor will act as a coach/advisor to the teams, and if necessary as facilitator in case of breakdowns in discussions. He or she will try to remove barriers and enhance constructive interaction among team members and across teams.

A team leader is selected for each team either by the instructor or the team members. The team leader will actually role play in class the project manager in the field. The team leader:

- Prepares the schedules and short agenda for the team meetings
- Makes sure that notes are taken on the proceedings
- Leads discussion, elicits and referees ideas and other issues on the subject
- Delegates assignments and follow up progress
- Makes sure that reports are prepared and presented to team members
- Devises feedback mechanism for further discussion of report with the members and other teams

For successful team output and before further discussion of the specifics of the case histories, the members of the team(s) should express their commitment to the group's mission and goals, objectives and procedures. They will participate actively in the problem identification and solution processes. They should feel free, absolutely uninhibited, to recommend ideas and alternatives. Most important, team members should carry out the delegated assignments from the team leader.

3.5.2 EXERCISES FOR STUDENTS/PARTICIPANTS

In phase 1, both class discussion and homework assignments could focus on the cost effectiveness of geotechnical investigations, especially for senior-level and graduate students in civil and environmental engineering and architecture. Failure to provide adequate funds and time for a thorough site study for a project such as TAPS ([Chapter 5](#)) results in costly construction delays. Additional questions are readily available in [Chapter 4](#). Different teams could summarize the costly consequences of inadequate site studies for several

different projects (library research) and then compare with TAPS ([Chapter 5](#)). All universities have a variety of reference books dealing with this subject matter, including reports by the State of Alaska and the U.S. Department of the Interior on TAPS specifically. Other source material on this topic can be found in the references and bibliography.

The instructor can provoke further team discussion in phase 1 by comparing the results of the above assignments with the feasibility studies ([Chapter 2](#)) and [Appendix B](#) in the text. Other aspects of phase 1 can be handled in a similar manner with respect to worker productivity, materials procurement, and communication problems in isolated locations such as in the arctic environment. Of course, the most important discussion topic in phase 1 should focus on the need to select a project manager (or management team) at the outset for overall responsibility and accountability (see [Appendix B](#)). For both civil and environmental engineering students, additional discussion and homework topics should include the innumerable environmental impact studies resulting from opposition of environmentalists and the creation of the Environmental Protection Agency.

The final designs and environmental impact studies logically continue into phase 2, serving as a basis for selection and approval. Specific discussion topics and assignments could initially focus on how Congress entered the picture, passing the Trans-Alaska Pipeline Authorization Act of 1973. What were the features of the Act and its impact, if any, on activation and implementation? Additional major assignments should include the many factors involved to activate a project of this complexity, ranging from scheduling of manpower and equipment needs to developing a preliminary control system such as CPM or PERT. Discussion of the construction cycle in the arctic environment and what studies were made prior to activation of the project would constitute another interesting assignment. This could involve additional library research to obtain past experience with projects constructed in the arctic.

In phase 3, the impact of a cumbersome project organizational structure ([Chapter 5](#)) on overall management will require critical discussions on relationships between and among the owners, designers, contractors, and construction managers. The marked decline in productivity should be thoroughly discussed in the context of the outstanding needs for (1) teamwork among the principal groups involved in this project (or any other project), and (2) selecting a project manager or management team with over-all responsibility and accountability. Additional discussion topics and questions can be taken from [Chapters 7, 8, and 9](#).

Evaluation and refinement (phase 4) are just as alien to students and many practitioners as the concept of IPQMS case histories. Thus, the instructor must both provoke team interest and thinking along with providing close guidance. An extremely useful assignment is to elaborate on a detailed checklist of questions and guidelines adapted from [Appendix B](#) for TAPS. Remember evaluation of a project is concerned with both socioeconomic needs and performance of each task in the IPQMS (see [Chapter 4](#)). The latter should be the focus of teams with students in architecture and engineering. A comprehensive assignment would have the teams evaluating each task in phases 1 to 3. Then, demonstrate how their evaluation could be used to improve policies, planning, design, and implementation of new projects. Another assignment for the teams would be to apply the IPQMS framework to costly problems in past projects, including structural collapses. These projects might include:

1. The Washington, D.C. Metropolitan Area Transit System (METRO) with costly overruns of budget compounded by litigation as a result of damage to adjacent properties.
2. The Washington State Public Power Supply System (WPPSS) design and construction of five nuclear power plants, with two plants abandoned (and two shelved) in varying stages of construction in the early 1980s and over \$24 billion wasted, default of State municipal bonds (\$2.25 billion), and on-going litigations (Chapter 7).
3. The tragic collapse of two atrium walkways in the Kansas City Hyatt Regency Hotel in 1981, killing 114 persons and injuring nearly 200 others.
4. The Spacecraft Challenger disaster in 1986, killing one school teacher and six astronauts. Of special interest here would be the management-engineer relationship: why Morton-Thiokol and NASA managers rejected the pleas of the design engineers to abort the lift-off (Chapter 9).
5. The Hanford Nuclear Reservation, Richland, Washington (1943–1996). Hanford was the nation's premier bomb factory in the country, and also the most contaminated. It is one of 16 principal sites in 13 states that have contaminated billions of gallons of water and millions of tons of soil with wastes from the bomb building

plants. Estimated costs of cleanup range from \$200 to \$300 billion over the next 20 to 30 years (see Chapter 9).

6. The Hartford-Connecticut Civic Center Roof collapse of 1978. The space frame was designed with the aid of a computer model (CAD). The roof, which covered two and a half acres of an arena, collapsed hours after thousands of fans had left.

Assignments include researching all the factors causing the problems and then, through team presentations in class, preparing a list of these problems, showing how many are common. Additional team assignments can be readily obtained from the training seminar outline in Chapter 10. Course research papers in the IPQMS framework are required by participants working in teams of three or four to illustrate the importance of teamwork.

3.5.3 IN PRACTICE

Many of the preceding examples of discussion and assignment topics will also be of interest to the practitioner. Of particular importance to the consulting engineers, architects, managers, environmentalists, and contractors, the lessons learned from past mistakes should be of primary concern (Chapters 5 to 9). Thus, the planning, design, implementation, and management of new projects should be more effective if the lessons are heeded.

In addition, practitioners should develop comprehensive checklists and guidelines for each new project to provide the necessary control systems to turn out safe and cost-effective projects. Practitioners must encourage the project owners to invest in thorough planning (phase 1) to satisfy the above objectives. In particular, the design professional (architect-engineer) should stress the importance of selecting the project manager who will be both responsible and accountable for proper implementation (see [Appendix B](#)). Another necessary step is to document each project to develop badly needed data bases of IPQMS case histories in public works project areas as well as other project areas. Ideally, teamwork with universities and consulting firms (and public agencies such as EPA) could be formed to permit graduate students to research and write these case histories for graduate credit (special projects course or thesis).

Experience with the use of IPQMS histories as a reference source in practice confirms their value in producing quality projects on schedule and within budget. They illustrate the importance of judgment in potentially controversial matters, thus avoiding litigation.

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